ACQUIRED CHARACTERS

Recent Experimental Evidence

By M. S. PEASE

THE question of acquired characters is one of no less practical importance to the social reformer than it is of irresistible interest to the philosopher. The certain establishment of Lamarckism would lay to rest once and for all any doubts as to the causes of evolution and any doubts as to the wisdom in the long run of eleemosynary legislation. To the eugenist the issue is vital.

Samuel Butler, still by far the ablest dialectician in the Lamarckist camp, clearly perceived the two weak spots in the defence. One was the adaptations of neuter insects and the other the absence of experimental proof. Both remain with us to-day. Butler put forward an ingenious (if somewhat fantastic) suggestion for the bees and ants, while he evaded the matter of experimental evidence by pointing to the enormous lapse of time required for any evolutionary change to become perceptible. Later arrivals in this field of controversy have, however, taken the converse line by evading the neuter insects and bringing forward successive champions to bear witness to the experimental evidence. As a result, it is true to say to-day that a number of experiments have been described which fit a Lamarckian interpretation, though usually it has not been difficult to find a selectionist interpretation as well. But it is equally true that every one of these instances, from the classic case of Brown-Séquard a generation ago to Professor McDougall's rats of to-day, has failed to obtain any confirmation.

A few years ago, the experiments of Harrison and Garrett on induced melanism in *Selenia bilunaria* seemed to be a striking case of the inheritance of an acquired character. Professor Harrison fed larvæ of this moth on leaves which had absorbed lead and manganese salts in solution, and thus produced experimentally a number of melanic moths. This induced type was inherited as a mendelian recessive. Here at any rate was a strikingly clear-cut case of induced change (though it is not quite so clear that this change was a purposeful adaptation arising from the enforced change of habit). Be that as it may, the experiment was clearly capable of confirmation at the hands of a competent and patient entomologist. This laborious undertaking was carried through by Mr. McKenny Hughes of the John Innes Horticultural Institute; his results, on a large scale with adequate controls, have proved completely negative.* No single case of an induced melanic turned up. It is true that Hughes's material came from the south-east of England and Harrison's from the industrial north; the two strains may have had different potentialities in their reaction to the metallic salts—but this would introduce a special hypothesis to explain a particular discrepancy. The simple fact remains that an attempt to repeat Harrison and Garrett's experiment resulted in failure.

Professor Haldane has contributed an analytical appendix to Hughes's paper and this has called forth an interesting rejoinder from Professor R. A. Fisher (*Proc. Royal Society*, B, Vol. CXII, 1933) on the evaluation of negative evidence in a mendelian experiment. In Hughes's case, Professor Fisher points out, the figures by no means exclude the possibility of the metallic salts being a causative agent of a mutation rate up to 5 per cent. per generation. What, however, Professor Fisher's calculations do show is that if lead and manganese are the causative agents of Harrison and Garrett's observed mutations, then these metallic salts induce a mutation rate of an altogether greater order of magnitude than that produced by the

* *Induced Melanism in Lepidoptera. Proc. Royal Soc.*, B, Vol. CX, 1932.

most effective known agency for inducing mutations, namely, *X* rays. It would seem, then, that Harrison and Garrett have proved too much; it would be simpler to suppose (as both Haldane and Fisher point out) that the mutant gene was already present in Harrison and Garrett's material.

The whole matter of acquired characters has recently been re-argued in the correspondence columns of *Nature* (June 4th-August 7th, 1932) by Professors McBride and J. B. S. Haldane. The new material for argument consists of the experiments by Metalnikoff, which seem to show the inheritance of induced immunity to disease in the bee's-wax caterpillar (*Galleria*). There is some obscurity as to exactly what precautions Metalnikoff took to rule out an explanation along ordinary selectionist lines; but at best it would be a wise caution, in view of the history of previous cases, to suspend judgment pending repetition of the experiment.

More recently the EUGENICS REVIEW has done good service in publishing an article by "Student"* in which attention is drawn to the important but oddly quite unnoticed experiments by Winter (*Journal of Agricultural Research*, July-December 1929) on selection in maize. Here we have a demonstration of the unexpectedly large range of potential variability. Isolated cases of this have long been known to geneticists—for example, Salaman's case of segregation for resistance to wart disease in potatoes from South America, where wart disease does not exist. But Winter's experiments have emphasized the general case for a measurable character; and in view of his results the position of selection requires restatement; clearly the effect of selection is not necessarily bounded by Johannsen's limits. The Lamarckist has always found it difficult to credit selection with any large share in moulding the course of evolution; it is possible that Winter's results may to some extent remove this difficulty, for it offers a mendelian-selectionist explanation for the unexpected rapidity with which a species responds by apparently purposeful adaptation to a change in external environment.

* January 1933, p. 293.